Evaluate the limits in questions 1 and 2.

1. \( \lim_{x \to \infty} \frac{9 - 3x^3 + 5x^4}{7x^4 - 8x^2 + 1} \)

2. \( \lim_{x \to -3} \frac{x^2 - 9}{x^2 - x - 12} \)

3. Let \( f(x) = 8x^5 + 5x^2 - 2x + 1 \). Find \( f'(1) \).

4. Let \( f(x) = 3x^{2/7} + 5 \cos x \). Find \( f''(x) \).
Find the derivative of the function $y$ in questions 5 and 6. Do not simplify the answer.

5. $y = (x^3 - 5x^2)\sin(x^7)$

6. $y = \frac{x^2 + \sec x}{1 + \sin x}$

7. Let the position of a particle at time $t$ be $s(t) = (5t^4 + \tan t)^{10}$. Find the velocity of the particle at time $t$.

8. Let $xy + \cos y = x^2 + y^2$. Find $\frac{dy}{dx}$ at $(1,0)$.
1. A rectangular field is to be enclosed by a fence and divided into 3 lots by fences parallel to one side. Find the dimensions of the largest field that can be enclosed with a total of 800 meters of fencing.

2. A certain bacterial culture is growing so that it has a mass of \( f(t) = \sqrt{t^3} + 1 \) grams after \( t \) hours.
   (a) How much did it grow during the interval \( 2 \leq t \leq 2.01 \)?
   (b) What was its average growth rate during the interval \( 2 \leq t \leq 2.01 \)?
   (c) What was its instantaneous growth rate at \( t = 2 \)?
3. A plane flying horizontally at an altitude of 6 miles passes directly over an observation station. If the distance from the plane to the base of the station is increasing at a rate of 400 mi/hr, what is the speed of the plane when it is 10 miles away from the station?

4. The graph of $f(x)$ is shown below.

![Graph of $f(x)$](image)

a) At what value(s) of $x$ (if any) is $f$ discontinuous? _______________

b) Find the equation of the line tangent to the graph of $f$ at $x=2$. (Estimate needed numerical values from the graph.)

c) Let $g(x) = 5x^2 + 7x + 3$ and $h(x) = f(x)g(x)$. Evaluate $h'(0)$. 